REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

Claims 1-19 were pending in this Application.

In the Office Action:

- Claims 1-6, 8-9, and 11-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,458,605 to Stirton ("Stirton") in view of U.S. Pub. No. 2002/0072003A1 to Brill et al. ("Brill").
- Claims 7, 10, 17-19 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In this Amendment, claim 10 has been amended. Accordingly, upon entry of the Amendment, claims 1-19 will be pending.

Objection to Claims 7, 10, and 17-19

The Examiner is thanked for the indication of allowable subject matter. Claim 10 has been amended to include all the subject matter recited in base claim 1 and intervening claim 8. Accordingly, upon entry of this Amendment, claim 10 should be in condition for allowance. Although the Examiner has indicated that claims 7, 10, and 17-19 also would be allowable if rewritten in independent form, for the reasons discussed below, Applicants believe that the underlying rejection of claims 1-6, 8-9, and 11-16 should be withdrawn and that claims 7 and 17-19 consequently are allowable in their present form. Accordingly, claims 7, and 17-19 have not been amended in this response.

Rejection of Claims 1-6, 8-9, and 11-16 under 35 U.S.C. § 103(a) as being Unpatentable over Stirton in view of Brill

Claims 1-6, 8-9 and 11-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Stirton in view of Brill. According to the Examiner, Stirton discloses a method and apparatus for controlling photolithography overlay registration, comprising, among other features, a substrate on which a test pattern comprising first and second pattern components is formed, the first pattern being different from the second pattern; and a means for measuring a reflection spectrum of the test pattern, means for measuring a reflection spectrum of a first reference pattern, and means for measuring a reflection spectrum of a second reference pattern. While acknowledging that Stirton does not teach the features recited in claim 1 of first and second reference patterns formed on a substrate, the Examiner asserts that Brill teaches such a feature. Specifically, the Examiner states that Brill teaches using a reference measuring tool (16) and optical measuring system (12), so that the reference data is determined at the same time as measurements taken by the optical measuring system. The Examiner states that it would be obvious to modify the invention of Stirton by the method of determining reference data at the time of determining a test pattern, as allegedly taught by Brill, in order to make an accurate measurement.

Applicants respectfully traverse the rejection of claims 1-6, 8-9 and 11-16 under 35 U.S.C. § 103(a) for the reasons set forth below. As a preliminary matter, Applicants point out that claim 16 recites distinctly different features from claim 1, and the rejection of the two claims is therefore discussed separately below.

Claim 1

- Combining Stirton with Brill in the manner suggested by the Examiner would not have been obvious because Stirton teaches away from such a combination.
- The combination of Stirton and Brill does not teach all the elements that are recited in claim 1.

Combining Stirton with Brill in the manner suggested by the Examiner would not have been obvious because Stirton teaches away from such a combination.

Stirton discloses a first method of controlling a lithography process by generating a reflection profile from first and second grating structures that overly each other (Abstract). The reflection profile is generated by a scatterometry tool that measures reflected light of the grating structures (column 5, lines 48-56) to determine the amount of misalignment. The reflection profile is used to determine overlay error and automatically adjust a recipe for a lithography tool based on the determined error (Figure 6). Alternatively, Stirton (Figure 5) teaches a second method wherein features that overly a grating structure are evaluated by comparison of the measured reflection profile from the features and grating structure with a reference reflection profile stored in a reference library (Figure 1).

As disclosed in Figure 1 of Stirton, the above methods employ a scatterometry measurement tool (tool 130), as well as reference data in the latter method (libraries 138, 139). Both the measurement tool and libraries form part of an *in line* system (see processing line 100) to control a lithographic process. Furthermore, as noted in column 2 lines 38-45, the teachings of Stirton are directed to controlling lithographic

manufacturing processes in a more *automated* manner. Thus, Stirton discloses using *in-line* tools to more *automatically* control manufacturing processes.

The Examiner asserts that it would be obvious to combine the teachings of Stirton with the teachings of Brill that disclose the use of a measuring tool 12 in conjunction with a reference tool 16. However, while the measuring tool 12 of Brill is an optical scatterometry measuring system (paragraph [0055]) that could be used in conjunction with a lithographic apparatus (Fig. 1), Brill explicitly teaches that the reference tool 16 is an *off-line* tool (paragraph [0056]). One of ordinary skill in the art would readily appreciate that, in the context of lithography and wafer manufacturing, an *off-line* tool is a tool that is not used in a manufacturing line. Thus, applying the overlay control method of Stirton with the reference tool of Brill, as suggested by the Examiner, would necessarily require off-line measurements to be performed. However, as noted above, the overlay control system of Stirton forms part of an *in-line* (processing line 100) system that is directed toward *increasing automation* in lithographic processing. One of ordinary skill in the art would therefore readily appreciate that Stirton teaches away from use of the *off-line* measurement tool 16 disclosed in Brill, which would tend to *decrease automation* in lithographic processing by requiring more *off-line* measurement of wafers. Accordingly, combining the teachings of Stirton with Brill in the manner suggested by the Examiner would not have been obvious.

<u>The combination of Stirton and Brill fails to teach at least two of the recited elements of claim 1</u>.

Even if it had been obvious to combine the teachings of Stirton and Brill, the combination of Stirton and Brill would not render claim 1 obvious because, for the reasons set forth below, the combination of Stirton and Brill fails to teach at least two of the recited elements of claim 1.

1. In addition to the feature of forming, at a surface of a substrate, first and second reference patterns corresponding respectively to said first and second pattern components, Stirton fails to teach an inspection method that includes the step of measuring a reflection spectrum of a test pattern, measuring a reflection spectrum of said first reference pattern, and measuring a reflection spectrum of said second reference pattern.

2. Brill also fails to teach forming, at a surface of a substrate, first and second reference patterns corresponding respectively to first and second pattern components.

Claim 1 recites, among other elements, an inspection method comprising forming, at a surface of a substrate, a test pattern comprising a combination of first and second pattern components, said first pattern component being different from said second pattern component; forming, at a surface of the substrate, first and second reference patterns corresponding respectively to said first and second pattern components; measuring a reflection spectrum of said test pattern, a reflection spectrum of said first reference pattern, and a reflection spectrum of said second reference pattern. As discussed below, neither Stirton nor Brill teaches these features.

1. In addition to the feature of forming, at a surface of a substrate, first and second reference patterns corresponding respectively to said first and second pattern components, Stirton fails to teach an inspection method that includes the step of measuring a reflection spectrum of a test pattern, measuring a reflection spectrum of said first reference pattern, and measuring a reflection spectrum of said second reference pattern.

First, the Examiner acknowledges that Stirton fails to teach forming, at a surface of a substrate, a test pattern comprising a combination of first and second pattern components, said first pattern component being different from said second pattern component, as recited in claim

1. However, the Examiner asserts that column 7, lines 37-60 of Stirton does teach a means for measuring a reflection spectrum of the test pattern, a reflection spectrum of the first reference pattern and a reflection spectrum of the second reference pattern; and deriving from the reflection spectra, information indicative of at least one parameter, as recited in claim 1 of this invention. It appears from this assertion that the Examiner equates the *means* for measuring reflection spectra from patterned structures alleged to be disclosed in Stirton with the *method* for measuring reflection spectra from patterned structures recited in claim 1. As discussed below, Stirton discloses neither a means nor method of measuring a reflection spectrum of the test pattern, a reflection spectrum of the first reference pattern and a reflection spectrum of the second reference pattern.

Lines 37-60 of Stirton refer to exemplary reflection profiles illustrated in Figures 4A-C, which may be stored in a library. The profiles may be generated by theoretical calculation (line 49) or by experimentally measuring reflection spectra from wafers. While Stirton may disclose an instrument to measure reflection spectra of a test pattern, the disclosed instrument falls well short of providing *means* for measuring a reflection spectrum of a first reference pattern and a reflection spectrum of a second reference pattern. The latter entails additional features. In addition to an *instrument to measure a test pattern*, as disclosed in Stirton, a *means* for measuring the reflection spectra would entail *the structure to be measured*, that is, the test pattern, first reference pattern, and second reference pattern, as well as possible additional instrument(s) for measuring the reflected spectra from the first reference pattern and second reference pattern, for example.

Therefore, because Stirton fails to even disclose the existence of the first reference pattern and second reference pattern structures, Stirton cannot be fairly construed to disclose a *means* for measuring a reflection spectrum of a test pattern, a reflection spectrum of a first reference pattern, and a reflection spectrum of a second reference pattern, let alone a *method* for measuring a reflection spectrum of a test pattern, measuring a reflection spectrum of a first reference pattern, and measuring a reflection spectrum of a second reference pattern, as recited in claim 1. Stirton, in fact, merely discloses measuring reflection spectra of overlay (test) structures (202,204, Figure 2A-C), and completely fails to disclose measuring reflection spectra of reference patterns. Nor does the Examiner suggest that Brill teaches this feature. Thus, the combination of Stirton, in view of Brill, even if it had been obvious to make (which it was not), fails to teach or suggest measuring a reflection spectrum of the test pattern, a reflection spectrum of the first reference pattern and a reflection spectrum of the second reference pattern.

2. Brill also fails to teach forming, at a surface of a substrate, first and second reference patterns corresponding respectively to first and second pattern components.

Although the Examiner acknowledges that Stirton does not disclose the claimed feature of forming, at a surface of a substrate, first and second reference patterns corresponding respectively to said first and second pattern components, the Examiner relies on Brill to cure this deficiency. According to the Examiner, Brill (in paragraph [0063]) discloses using a reference tool 16 and optical measuring system 12, such that reference data is determined at the same time as optical measurements. However, Brill does not teach forming, at a surface of a substrate, first and second reference patterns, as recited in claim 1, let alone the formation of those reference patterns on the *same* substrate.

For convenience, the paragraph from Brill relied on in the Office Action is shown below in its entirety.

> Optionally, the reference measurement tools (16 in FIG. 1) is applied to the same test fields, and measurement results are added to the reference data. For example, if CD-SEM is used as the reference tool, then all FEM fields for which optical (diffraction) signatures were measured are also measured by the CD-SEM, and CD values obtained with this tool are stored for each field, along with the process conditions of that field and the optical signatures measured in that field. The bulk of all measurements, both of the measurement apparatus (12) and of the reference tools (16) stored in correlation with each field's production parameters, is generally referred to as the "reference data" or "signature library". It should be noted that the test wafer (fields) may be measured by the reference tool at the same state as measured by the measuring apparats 12, or at another state, e.g., after additional processes have been applied to the wafers or before some process were applied thereto. For example, whereas the measuring apparatus 12 may be measuring the test fields after the photoresist development stage, the reference tool measurements may be taken after the subsequent etch and clean stages. Alternatively, the reference measurements may be electrical measurements carried out on other structures in the same fields, at the end of the line. This possibility allows the system to correlate the signature measured in one (preparatory) stage with the outcome of a later stage. Using the reference tool allows for defining a process window, e.g., a range of allowed CD values. Correspondence between the control parameters (F-E) and the reference tool results (CD) results in a range of allowed control parameter sets (F-E), which could be used later on during production run. Based on the reference tool data, the nominal values for the control parameters (F-E) can also be determined as a set of parameter resulting in the best structure (profile).

As evident from the above paragraph, Brill discloses measuring fields on a wafer (FEM fields) by employing optical measurements in conjunction with a reference (off-line) tool, such as CD-SEM, which is used to collect reference data. Although Brill teaches measuring an FEM field using both optical measurements and CD-SEM measurements, nowhere does Brill disclose or suggest forming, at a surface of a substrate, first and second reference patterns corresponding respectively to first and second pattern components (of a test pattern), as recited in claim 1, let alone the formation of those reference patterns on the *same* substrate.

In sum, the teachings of Stirton remains deficient in at least two elements with respect to features recited in claim 1: 1) Stirton does not disclose an inspection method that includes the step of measuring a reflection spectrum of a test pattern, a reflection spectrum of said first reference pattern, and a reflection spectrum of said second reference pattern; 2) Stirton fails to disclose forming, at a surface of the substrate, first and second reference patterns corresponding respectively to said first and second pattern components. Brill likewise fails to teach both of the above features that are missing from Stirton. Thus, the combination of Stirton and Brill falls well short of teaching all the elements recited in claim 1. Accordingly, claim 1 is non-obvious and patentable over Stirton, even if read in view of Brill, and the rejection of claim 1 under 35 U.S.C. 103(a) should be withdrawn.

In addition, the rejection of dependent claims 2-9, and 11-15 was premised on the rejection of base claim 1, which, for the reasons set forth above, should be allowable. Accordingly, inasmuch as maintaining the rejection of claims 2-9 and 11-15 would be improper, Applicants request that the rejection of claims 2-9 and 11-15 under 35 U.S.C. § 103(a) be withdrawn.

Claim 16

Claim 16 recites, in addition to the elements discussed above with respect to claim 1, a method for device manufacturing comprising providing a substrate that is at least partially covered by a layer of radiation-sensitive material; providing a projection beam of radiation using a radiation system; using patterning structure to endow the projection beam with a pattern in its cross-section; and projecting the patterned beam of radiation onto a target portion of the layer of radiation-sensitive material. Applicants note that these features are not explicitly disclosed in the

cited art, nor referred to in the rejection of claim 16 in this Office Action. Accordingly, the Examiner has not set forth complete grounds of rejection for all the elements recited in claim 16.

Moreover, in other relevant parts, claim 16 recites substantially similar features to claim 1 and remains patentable over Stirton in view of Brill for all the reasons set forth above with respect to claim 1. Accordingly, Applicants respectfully request that rejection of claim 16 under 35 U.S.C. § 103(a) be withdrawn.

In addition, the objection to dependent claims 17-19 was premised on the rejection of base claim 16, which, for the reasons set forth above, should be allowable. Accordingly, inasmuch as maintaining the objection to claims 17-19 would be improper, Applicants request that the objection to claims 17-19 be withdrawn.

In view of the foregoing, all of the claims in this case are believed to be in condition for allowance. Should the Examiner have any questions or determine that any further action is desirable to place this application in even better condition for issue, the Examiner is encouraged to telephone Applicants' undersigned representative at the number listed below.

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